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A Plain Statement

Because there is a tendency by the man-in-the-street to regard the foundry industry as part and parcel of the iron and steel industry, we believe a statement is necessary to set out exactly the structure of our industry. One oft-used division is steel; iron, including malleable; heavy non-ferrous; light alloy and die castings. Of these, three are completely divorced from iron and steel, but are interlinked technically. They possess their own employers' organisations, whilst the employees in some sections belong to the Amalgamated Union of Foundry Workers or the National Union of General and Municipal Workers. Thus confining ourselves to the iron and steel section, we will endeavour to clarify the situation by dealing with the industry by activities, touching first upon wages.

Generally speaking, this activity is dealt with through negotiations instituted between the Engineering and Allied Employers' Federation or the National Light Castings Federation and the appropriate unions. General employer activity is handled by the Council of Ironfoundry Associations and the British Steel Founders' Association. Research for cast iron is carried out by the British Cast Iron Research Association, the technical activities being undertaken by the Institute of British Foundrymen. The connection of the ironfounding with the iron and steel really started during the war when the Directorate of Iron Castings was housed in the Iron & Steel Control. Since that time, the British Iron and Steel Federation has undertaken the responsibility of collecting and supplying most of the vital statistics of the ferrous industry.

Since the establishment of the "Steel Board," that body has assumed control over many activities. It has very wide powers. The steel foundry has long had an association with the various bodies connected with iron and steel, but increasing independence is being shown since the industry reorganised itself as the British Steel Founders' Association. It is still dependent on the B.I.S.F. for its statistics. From all this, it will be seen that so far as wages are concerned the iron foundry is either self-contained or part of the engineering industry; so far as research and technology is concerned it is self-contained. Skilled labour is covered by a large craft union with 70,550 members, whilst we suppose that most of the other 200,000 or so belong to the labour unions. The former is quite self-contained and has little to do with iron and steel whose workers are separately organised. Statistically and politically, however, the iron and steel foundries are now part and parcel of the iron and steel trades. We often wonder why! This pondering is due to a desire on our part to relieve the industry of as many entanglements as possible. When there is talk of making iron and steel a State monopoly, there is an assumption by some that this would include the foundry industry. This is by no means a proper conclusion to draw. For many years, the Government has owned foundries located in dockyards and arsenals. It received one or two establishments when the coal mines became state owned. It will take over quite a few with the nationalisation of the railways. The full implementation of legislation now envisaged by the Government would account for about 25 per cent. of the output of the iron foundries by weight, but not by value. That is the worst that can be expected.

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"Enterprise Scotland"

The "Enterprise Scotland" Exhibition, which opened at the Royal Scottish Museum, Chambers Street, Edinburgh, on August 25, has been designed as the Scottish counterpart of the "Britain Can Make It" Exhibition. It is a small exhibition concentrating on the variety of wares which Scotland is producing, with particular emphasis on their export value and their part in Scotland's economy.

The hall is divided into sections intended to show in sequence how the industries in Scotland have developed. The first section, "History," shows how great men of the past—Lord Kelvin, James Watt, Henry Bell, Foulis and Neilson—have influenced the trends of industry. The next section, "Country," is devoted to tourist interests. "Shipbuilding," which comes third, is of the greatest potential interest to founders because it represents Scotland's heavy industries; in 1946 more than one-sixth of the world's production of shipping was built in Scotland.

In "The Hall of Pinnacles" domestic goods are put in the shop window, and particular interest is focussed on gas and electric cookers and baths of modernistic design which are produced by Scottish foundries. The final section of the Exhibition, "Scotland Tomorrow," is intended to be a symbolic expression of the uphill work in industrial planning. There is a cinema showing documentary films and, in the exit corridor, a varied supply of literature.

To the visitor who is looking for indications of how Scotland is showing greater enterprise than other areas, the exhibition may be superficially a little disappointing, but a closer examination into Scottish industry behind the scenes will show that Scotland is to the forefront of development in many spheres. Her surplus of labour, high record of coal production, future cheap electricity, and availability of factory estate premises may well attract employers, especially if the words of Sir Stephen Bilsland are reflected by all sections of the community. He said, "Scotland means business—she has the will and the capacity to forge ahead, and her industries will not be dictated to by bureaucracy."

Industrial Accident Prevention

A National Safety Congress is to be held at Brighton from October 7 to 10 next. The Congress is being organised by the Royal Society for the Prevention of Accidents, which this year celebrates its silver jubilee as a national organisation. The industrial sessions will include two Papers on safety methods in American factories. These will be given by Mr. L. N. Duguid, H.M. Superintending Inspector of Factories, and Mr. R. E. Tugman, of Imperial Chemical Industries, Limited. Other matters to be discussed include noise abatement in industry, floor surfaces and their effect on falling accidents, and the guarding of milling machines. Full particulars of times, fees, etc., may be obtained from the Society's Industrial Safety Division, 131, Sloane Street, London, S.W.1.

B.S.I. Specifications for Zinc

British Standards, Nos. 220, 221, and 222, for 1947, cover fine, special and foundry qualities of zinc. We have assembled these specifications in the form of a table:—

Specn. No. .. / Quality ..	220 Fine Grade A	220 Fine Grade B	221 Special	222 Foundry
Zinc ..	99.95 (min.)	99.90 (min.)	99.50 (min.)	98.50 (min.)
Lead ..	0.03 (max.)	0.08 (max.)	0.20 (max.)	1.25 (max.)
Iron ..	0.01 (max.)	0.01 (max.)	0.05 (max.)	0.07 (max.)
Cadmium ..	0.02 (max.)	0.03 (max.)	0.25 (max.)	0.25 (max.)
Arsenic ..	Nil	Nil	0.02	0.02
Antimony ..	Nil	Nil	(max.)	(max.)
Aluminium ..	Nil	Nil	Nil	Nil
Tin	Nil	Nil	Nil	0.02 (max.)

These figures form Section I of the Specification. Section II sets out a method of sampling common to all. If, upon analysis, the representative sample taken in the manner prescribed is found not to conform to the limits stated for the chemical composition, the batch may be rejected. The three specifications are assembled into one publication which is available from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s., post free.

Foundry Query

A foundry manager in North Midlands writes:—

"We have to cast 50 cast-iron rollers detailed in the accompanying sketch. We shall be grateful if any of your readers can give us advice as to the best way of tackling this job, as we anticipate trouble with the core."

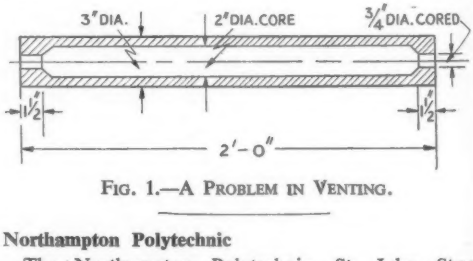


FIG. 1.—A PROBLEM IN VENTING.

Northampton Polytechnic

The Northampton Polytechnic, St. John Street, London, E.C.1, opens the 1947-1948 session on September 29. It is, as usual, providing courses in several branches of applied chemistry, which for sake of convenience includes metallurgy. The head of the department, Dr. J. E. Garside, takes a special interest in this subject, and in recent years the classes have been very successful. A feature of this school is the organisation of part-time day courses supplemented by evening lectures.

THE FOUNDRY TRADES' EXHIBITION

Olympia Houses Four Industrial and Technical Exhibitions

Meet Your Friends at Stand No. F.13 (Phone: Renown 3792).

Readers are cordially invited to visit the stand of the FOUNDRY TRADE JOURNAL, which is in conjunction with the stand of the Institute of British Foundrymen, where every assistance will be afforded.

Held as a section of the Engineering and Marine Exhibition, the Foundry Trades' Exhibition, at Olympia, London, was officially opened this morning by Mr. Chuter Ede, the Home Secretary. Until September 13, Olympia will be the centre of activity for technicians throughout the country. There are to be official visits from the Institute of British Foundrymen, the British Cast Iron Research Association, the Foundry Trades Equipment and Supplies Association, and the Institute of Vitreous Enamellers. Raw materials for the industry are well represented, but though there are a number of important exhibits of foundry equipment, industrial conditions have unfortunately prevented it from being truly representative of the industry. Moreover, not all the firms showing can guarantee reasonable delivery, though orientation due to the crisis may alter the situation. Also incorporated in the Exhibition, which was held first in 1906, is a section on welding trades and techniques, while in another sector is "Industrial Wales." The following descriptions of the stands of interest to foundrymen are arranged alphabetically, the headings indicating the principal feature of each stand:—

Light Alloys
(*Stand No. 4b*)

Almin Limited (*Associated Light Metal Industries*), Farnham Royal, Bucks, show a wide range of castings made by *Renfrew Foundries Limited*, who operate one of the largest mechanised light alloy foundries in Europe. The casting illustrated in Fig. 1 is a 2-cyl. diesel engine block cast in an aluminium alloy (AC7). It weighs 112 lb., and its dimensions are 1 ft. 4 in. × 1 ft. 6 in. × 1 ft.

Paint
(*Stand No. J.15*)

Atlas Preservative Company Limited, Erith, Kent. The only reason why this prominent firm of paint manufacturers is included amongst foundry supplies is because their technical staff has paid special attention to the requirements of this industry. As the colouring of foundries is amongst the newer amenities to be included in foundry "good housekeeping," opportunity will be afforded of discussing the potentialities of this development.

Electric Furnaces
(*Stand No. A.9*)

Birlec Limited, Tyburn Road, Erdington, Birmingham have as a feature of their exhibit, a demonstration of high-frequency induction heating. The demonstration unit shows how localised heating—for hardening or other purposes—can be applied rapidly, uniformly and with complete regularity to small parts by means of a mechanised feeding arrangement giving a high production of strictly uniform quality without requiring highly skilled operation.

In addition, the latest type of Birlec rocking indirect arc electric melting furnace is on show. This equipment, built in capacities from 10 lb. to 1,000 lb. or larger, affords exceptionally rapid melting and close metallurgical control in both brass foundry and iron foundry work, being particularly suitable for making complex alloys of either ferrous or non-ferrous types. The furnace exhibited is of 500 lb. charging capacity. Heat-treatment equipment is represented by a Birlec standard model RP20 general purpose furnace as widely used for annealing, carburising, hardening, tempering, and other heat-treatment operations in toolrooms or small-scale production shops. Completely automatic temperature control is provided, and a feature of the design is the provision of a heating element on the inner face of the door which neutralises front losses and ensures completely uniform heating throughout the furnace chamber. This furnace is being shown in operation. Its chamber dimensions are 24 in. × 12 in. × 8 in. high, and larger models up to approximately 5 ft. × 3 ft. × 1 ft. 6 in. are available. The large production furnaces built by the company, both for melting and heat treatment, including high-frequency induction heating apparatus of various kinds, are represented by illuminated photographs and technical literature. In addition, a small working model of the Birlec-Tama low-frequency induction melting furnace for aluminium and light alloys is exhibited.

Magnetic Moulding Machines
(*Stand No. O.7*)

The British Insulated Callender's Cables, Limited, though not in the Foundry Section, show a magnetic moulding machine known as the SS (squeeze strip) 324. The one chosen for exhibit is the smallest of the range manufactured. The particular model is to be eventually used to produce moulds for automobile castings from moulding boxes 17 in. × 13 in. × 3½ in. to 5 in. deep. The power unit is of standard type, but the stripping frame and combined machine table and pattern plate supporting stool are built to suit the requirements of individual customers. All operations are controlled by push-button. The solenoid power

Foundry Exhibition

unit operates from a 240-volt d.c. supply, the momentary consumption being 38 amps. For the rectification of the three-phase alternating current available at Olympia, a mercury-arc rectifier has been installed adjacent to the machine, while the controller has been attached to the steel structure supporting the machine below floor level. Normally, under working conditions the rectifier is installed in a sub-station and the controller in a suitable position adjacent to the machine above floor level.

A pattern plate vibrator is attached to the machine table and arranged to operate from a single-phase a.c. supply, while a pattern plate heater is fitted inside the machine table. This heater unit can be altered to work either on d.c. supply (and act as a maintaining load for the mercury arc rectifier) or alternatively; from the single-phase a.c. supply.

Moulding Machines

(*Stand No. G.*18)

The British Moulding Machine Company Limited, of Faversham, Kent, as the name indicates, concentrate their activities on the design and manufacture of moulding machines for the making of all types of castings. Their stand shows a range of these functioning under conditions as near to actual foundry practice as possible. Of particular interest is a semi-automatic moulding machine specially built to produce moulds rapidly for steel castings urgently required for coal-producing machinery. This machine is of the "press-the-button" type, and is similar to all the other machines displayed in that it can be operated by the greenest of "green" labour. An entirely new type of moulding machine is the S.H. Type (Fig. 2), which is itself constructed largely from steel castings and weighs approximately five tons. The machine operates on the "down sand" or "under sand" principle, by which the pattern is rammed under pressure into the pre-filled box of sand. There are no control levers in the conventional sense of the word, but there are instead two press buttons for foot operation. After the box has been filled from an overhead hopper, one of these buttons is depressed and most of the moulding cycle is then automatic and sequence controlled, causing the mould to be squeezed, turned over, vibrated, and stripped without further attention from the operator. The second push button is for the purpose of returning the machine to its original position.

FIG. 1.—TWO-CYLINDER DIESEL ENGINE BLOCK CAST IN ALUMINIUM ALLOY BY ALMIN, LIMITED.

This machine is extremely fast, and will produce in excess of one hundred moulds per hour. Such is the design that although moulding is normally a skilled operation, an unskilled person from any walk of life could operate this machine and produce moulds at the previously mentioned rate of production with no more than a few minutes instruction.

Pig Irons

(*Stand No. H.*19)

British Pigirons Limited, Abbey House, 2, Victoria Street, London, S.W.1, exhibit representative samples of "Glenhill" and "Midhill" all-mine special pig iron, together with fractures, test pieces, photomicrographs and castings. This firm, in the halcyon days of peace, originated the notion of selling parcels of pig iron from stock, the composition and properties of which had all been ascertained and tabulated. Now they do their best to keep their customers happy.

Crucibles and Refractory Shapes

(*Stand No. E.*18)

The Carborundum Company Limited, of Trafford Park, Manchester 17, show a wide range of crucibles, basins and stands. The exhibits also include a variety of Carbofrax and Alfrax shapes, bricks, tiles, muffles, and tubes, with a display of refractory cements for high-temperature use.

Tools for Castings

(*Stand No. A.*19)

Coleman Foundry Equipment Company, Limited, Windsor Works, Stotfold, show a series of modern tools for the production of castings. Designed during the

war period is an abrasive cut-off machine, which in these days of precision working finds increasing popularity. Another machine which has been necessitated through the advent of mechanisation is a core wire straightener. The type of core blower shown is of the horizontal type and is particularly robust. These machines, together with a range of moulding machines, are being shown in operation. Space considerations have unfortunately precluded the inclusion of a new design of continuous sand mill, but its details are available on the stand.

Foundry Plant

(*Stands Nos. F.*11 *and F.*17)

The Constructional Engineering Company Limited, of Titan Works, Charles Henry Street, Birmingham, in conjunction with their associated firms, *Adaptable Moulding Machine Company Limited* and *E. Tallis & Sons Limited,* are exhibiting the following plant. For the melting of cast iron they show a bottom section of a "Titan" cupola, which is made in capacities ranging from 1 to 20 tons per hr.; a Pari-blast cupola, which incorporates individual air control to each tuyere in conjunction with "Metronic" instruments, and a "Titan" cupolette having a capacity of 10, 15 and 20 cwts. per hr. For drying there is an oil-fired "Korex" core stove, though a range is available for burning gas or solid fuel. There are several exhibits of geared crane ladles and a special type of drum ladle.

Shown for the first time is a horizontal centrifugal casting machine with full electronic control giving infinitely variable speeds. The range available also includes vertical as well as horizontal machines for all types of castings. Three models of Adaptable moulding machines are shown, so as to include a standard machine for straight pattern draw, with turnover attachment and 12-in. lift; a standard squeeze machine having a 5-in. pattern draw, and a "Duplex" roll-over machine with a 12-in. draw. The plant exhibits on this stand are completed by a motor-driven portable sand riddle which is easily transportable and capable of handling 1 cwt. per min.; a range of snap flasks made of well-seasoned wood and malleable iron fittings; and pattern duplicators for the production of transfer plates by the quickest and cheapest method. The only exhibit in the supplies section is the well-known pattern stone "Titanite." On a second stand (No. 17, Row F.) there is an important exhibit of airless shot-blast plant. It is a 44 in. × 32 in. rotary barrel-type "Sand Wizard" complete with dust extraction plant. It is shown in operation. The range of machines available includes a rotary table and a continuous type machine. On this stand there are also two core-blowing machines, which form a complete working unit of two sizes of machines demonstrating the speed and ease with which all types of cores can be produced. The balance of the exhibits is made up of a motor-driven Titan core sand mixer of 130 lb. capacity, which is shown in operation, and a vibratory knock-out. The latter is a working exhibit of a pneumatic vibratory knock-out suspended from overhead monorail.

Industrial Research

(*Stand No. C.*14)

The Department of Scientific and Industrial Research have a stand in the Gallery of the Grand Hall. The exhibits include demonstration models, new testing equipment, new materials, methods of increasing efficiency of boilers by smoke elimination, improvements in welding technique, etc. The National Physical Laboratory shows some part of its work in engineering, metallurgy and metrology. By means of photographs, the Metrology Division shows methods and instruments used in assessing the finish of various surfaces. Work carried out by Research Associations is illustrated by specially designed apparatus, models and photographic exhibits. A model blast furnace gives an indication of how investigations are carried out on distribution of raw materials within the furnace, at the laboratories of the British Iron and Steel Research Association. Samples of finish on cast iron with data on their uses is one of the exhibits shown by the British Cast Iron Research Association to show the general research into building and engineering uses of

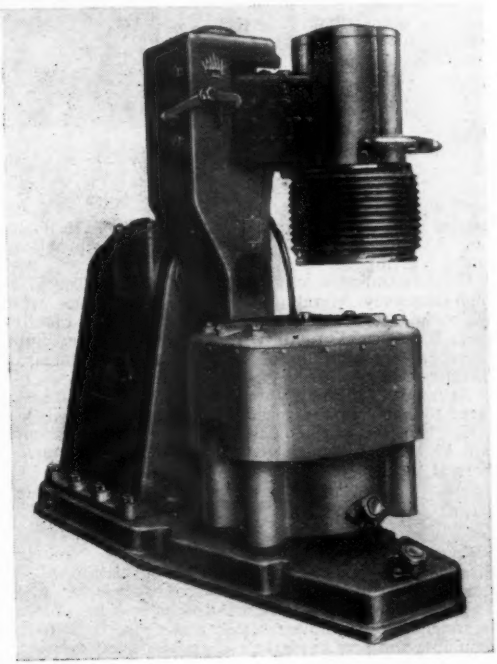


FIG. 2.—THE NEW S.H. TYPE MOULDING MACHINE BY THE BRITISH MOULDING MACHINE COMPANY, LIMITED.

Foundry Exhibition

cast iron. The British Non-Ferrous Metals Research Association illustrates its research work on such problems as corrosion and fatigue. Weldability tests employed for research purposes make one of the exhibits shown by the British Welding Research Association.

Magnetic Equipment

(*Stand No. J.*16)

Electromagnets Limited, Bond Street, Hockley, Birmingham, show a selection of "Boxmag" standard and special permanent electromagnetic equipments, many of which are in operation demonstrating efficiency and representing new types and improvements based on the experience gained during the war period. The range shown covers a wide variety of machines meeting many industrial requirements, such as lifting magnets, magnetic separators, clutches, brakes, chucks, hold-down gear, and the like applied generally for protection, reclamation, purification, and transportation purposes, or where used for transmission of power, holding down work during machining and other operations and where welding processes are carried out. A technical staff will be available throughout the whole of the period for discussing problems and for giving advice respecting applications.

Of outstanding interest to vitreous enamellers is a high-frequency vibrating wet sifting machine, with which is incorporated a magnetic separator. Finally, there is a portable foundry sand sifting machine. Both these items are produced by an associated company, *Blending Machine Company Limited*.

As many of the newly developed equipments are too large to show in the space available, visitors will be invited to the works, or alternatively arrangements will be made for them to see plants operating under normal working conditions.

Foundry Services

(*Stand No. A.*17)

Foundry Services Limited, of Long Acre, Nechells, Birmingham, have for many years developed a service for producing better castings at lower cost. This is accomplished by control over melting, correct treatment of the molten metal, and properly adjusted moulding and core sands, together with correct dressings for the metal or alloy to be cast. Ferrous, non-ferrous, and light alloy founders are catered for in this comprehensive service, which also includes the die-casting industry. Samples of most of the fluxes and preparations can be seen and examined at the stand. Moreover, their composition in most cases can be detailed.

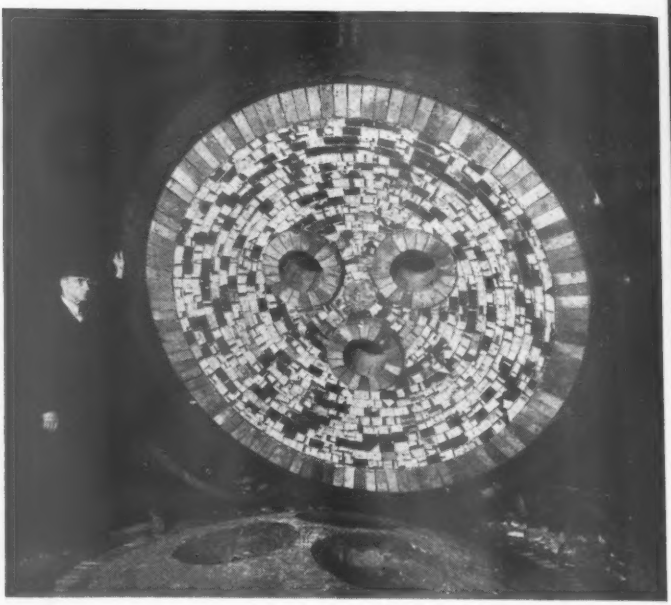


FIG. 3.—SILLIMANITE ELECTRIC FURNACE ROOF AS EXHIBITED BY GENERAL REFRACTORIES, LIMITED.

One of the most important developments in connection with the melting of gunmetals and bronzes is the oxidation-reduction technique for ensuring maximum density and minimum gas content. "Foseco" Cuprex blocks are a simple and effective means of obtaining the required oxidising flux and degassing treatment automatically and simultaneously. Reduction or deoxidation is carried out as a final operation before pouring by plunging D.S. deoxidising tubes. The technique as applied to phosphor and high zinc bronzes is slightly modified.

Hydrogen is a constant source of trouble when melting and casting aluminium alloys, unless suitable precautions are taken. Foseco Coverals provide a cleansing and protective flux cover whilst Degaser tablets offer an efficient means of sweeping out dissolved gas without the risk of complicated equipment involved in the flushing treatment with chlorine or nitrogen gas.

"Terracoats" and "Mouldcoats" for dressing both dried and green sand moulds are featured. Special grades are available to suit different casting alloys in the non-ferrous and light metal fields, whilst "Terrapowders" offer the same facilities for cast iron and steel.

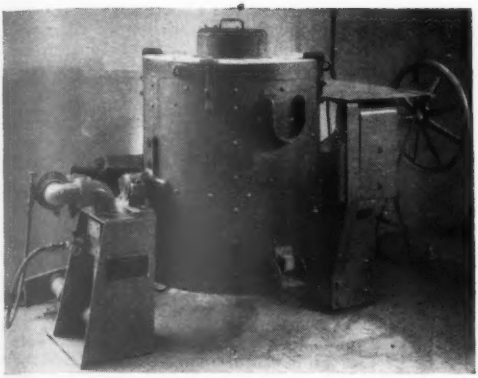


FIG. 4.—OIL-FIRED TILTING CRUCIBLE FURNACE, CENTRAL AXIS TYPE, SHOWN BY THE MORGAN CRUCIBLE COMPANY, LIMITED.

To facilitate the application of these dressings and of die-coats a variety of spray guns are provided. These, too, will be available for inspection. One of the most popular models is the "S" Gun. Technical personnel will be present to deal with problems, queries, and to give all possible advice and explanations about the products shown or to discuss any founding difficulties visitors may care to bring forward.

Refractories

(*Stand No. F.*12)

Exhibits by *General Refractories Limited*, of Genefax House, Sheffield 10, cover the refractories requirements of all types of industrial furnaces. Basic refractories exhibited include a comprehensive range of magnesite, chrome-magnesite and dolomite bricks for open-hearth, electric, and re-heating furnaces, cement kilns, etc. Of special interest are the dolomite "341" bricks, manufactured entirely from British dolomite. These bricks played an important part during the war, and in this period their development was advanced sufficiently to enable them to be used in place of previously imported materials, in comparison with which they have given equal, and in many cases superior performance in use, and their development and manufacture is being continued on a large scale.

Firebricks exhibited include the well known "Glenboig," "Davison," and "Foster" ranges for industrial furnaces generally. Specially featured on the stand is an electric furnace roof in sillimanite material (Fig. 3), and an exhibit of "Amberlite" heat-insulating products in which the low thermal conductivity of these materials is demonstrated with special reference to their function in reducing heat losses in furnace structures with resultant fuel economies. Samples of moulding and silica sands to meet every requirement are on view, together with many examples of fire cements, jointing materials, and monolithic ramming compositions.

To emphasise the importance of refractories to daily life, an exhibit shows the relationship between them and many of the industries in which they are used, and examples are shown of commodities the manufacture of which would not be possible without this "Industry behind Industry."

Monolithic Furnace Linings

(*Stand No. D.*16)

Thomas E. Gray and Company Limited, of Granby Chambers, Gold Street, Kettering, are showing a section of a cupola rammed with Ramolith, a furnace door monolithically lined with Ramolith plastic brick, samples of other refractory settings and patchings and parting powder, all of their own manufacture.

Sodium Hydride Descaling

(*Stand No. D.*14)

Imperial Chemical Industries Limited have two stands. For foundrymen, however, it is the one showing the products of the Alkali Division which is of

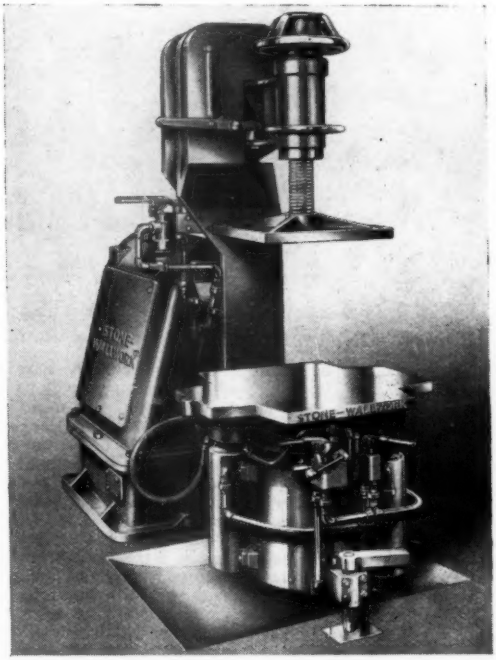


FIG. 5.—TURNOVER MOULDING MACHINE (STONE-WALLWORK, LIMITED).

Foundry Exhibition

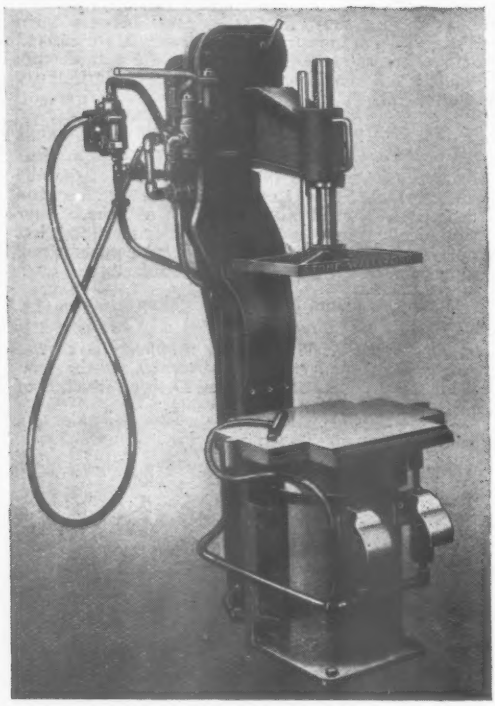


FIG. 6.—STONE-WALLWORK SNAP-FLASK MOULDING MACHINE.

major interest. The stand features an entirely new process for the descaling of metals, and developments in the use of sodium carbonate for metal refining and of caustic soda for de-enamelling steel. Sodium carbonate has long been used, in several branches of iron and steel manufacture, for refining metal. It has now been proved that the use of a basic lined ladle enables 80 per cent. of the sulphur in cast iron to be removed, or 30 per cent. more than is possible with a siliceous lined ladle. Demonstrations have also shown that phosphorus can be removed from low silicon cast iron by treatment in a basic lined ladle with a mixture of sodium carbonate and mill scale.

The sodium hydride process provides a new technique for descaling metals. When sodium hydride—a powerful reducing agent—is present to the extent of about 2 per cent. in a bath of molten caustic soda, held at a temperature of 350-370 deg. C., oxide scale is reduced to a soft metal powder which is easily removed, and there is no attack on the underlying metal. No corrosive fumes are given off, nor do the chemicals employed attack the mild steel used for construction of the plant—a model of which is exhibited. The fact that steel is in such short supply lends an added interest and importance to the third process described on the stand. This shows the considerable progress that has recently been made in the technique of removing vitreous enamel from steel by means of molten caustic soda or strong caustic soda solution.

Meehanite

(*Stand No. G.17*)

The International Meehanite Metal Company Limited, 66, Victoria Street, London, S.W.1, are endeavouring to carry out two purposes:—(1) To show designers and engineers the known and guaranteed properties of Meehanite metal, and (2) to demonstrate the wide range of its uses in industry. This is carried out by dividing the stand into definite parts:—Fatigue strength, corrosion-resisting, heat-resisting, wear-resisting, and so forth. Under these headings there are exhibits of photographs and small samples castings. The photographs cover such items as Polar diesel engines where the majority of the castings are in Meehanite metal; corrosion-resisting chemical pots; machine tools and other parts where service conditions demand exacting properties.

In addition to the small castings, which cover such matters as stoker grate links, parts of predictors and the like, apparatus demonstrating the physical properties is shown. Of particular interest on this stand will be a series of cast crankshafts showing the uses of Meehanite metal for the wide range of crankshafts required in industry.

Moulding Machines

(*Stand No. D.17*)

J. W. Jackman & Company, Limited, Vulcan Works, Blackfriars Road, Manchester, 3, have exhibits covering sand preparation, mechanical moulding, core blowing and shotblasting. Into the first section enters a sand mill and mixer having a conical roll mounted on taper roller bearings completely enclosed. The pan is dish-shaped with sloping side rotated by undergearing and fitted with renewable wear-resisting path plate.

A second exhibit in this section is a motor-driven gyratory sand sifter arranged to discharge the tailings during sifting. Gyration is due to rotation of out-of-balance weight fitted to the lower end of the vertical shaft which has ball bearings top and bottom, protected from dust. The drive is from a ½ h.p. motor through totally enclosed gearing.

In the moulding-machine section a selective range is shown of both hand and pneumatically operated types. Of the former is a small hand operated press with swinging presser head, adjustable in height for different depths of boxes. The ramming of the sand is effected, with little effort on the part of the operator, by lever in front of the machine. Accurate separation of mould from pattern is ensured by a lifting frame carrying the lifting pins being guided in its movement by two side

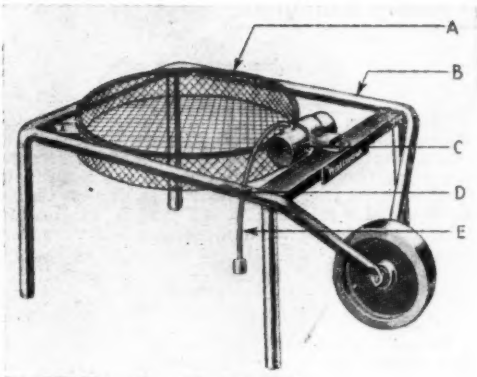
cylinders having long plungers. The range of machines of this type is from quite small boxes up to 30 by 21 in., associated with mould lifts from 3 to 5½ in.

The pneumatic machines shown are of the Osborn design. Four types are shown. One is a pneumatic jolt squeeze stripper of new design embodying features for rapid production of accurate moulds. Size 712PJ, as shown, takes boxes up to 18 by 28 in. with a pattern draw up to 6 in. The pattern vibrator control is adjustable for length of vibrating interval and is automatically synchronised with draw mechanism. The pattern is controlled by combination hand and knee valve so that operator can lower the draw frame by knee action, while both hands are engaged in lifting off the mould.

The second type is a pneumatic roll-over jolter to take single or double-sided pattern plates and boxes up to 30 by 24 in. overall; it is known as Size 601 and the main features are a pattern draw of 10 in., and a jolt cylinder of 4½ in., associated with a jolt capacity of 600 lb. The rollover table of light aluminium alloy is offset so that the weight of pattern plate and box, above and below trunnion level, is equalised, and therefore readily rolled over by hand. Quick-acting clamps, adjustable for different lengths and depths of boxes, secure the boxes in position, cotters being unnecessary. The third machine is a pneumatic jolt lift machine of simple design and construction for wide variation in size and depth of moulding boxes. Separation of the mould and pattern plate is by four lifting pins carried in horizontal arms rigidly secured to lifting yoke. The horizontal arms can be moved radially and have slots to carry the pins. The maximum box size is 28 in. square, the mould lift 8 in., and the jolt capacity 350 lb. The control for jolting and lifting is again by single lever.

The machine shown for core blowing is the Osborn pneumatic core blower, designed for making cores up to 15 lb. in weight. It is fitted with an automatically operated air clamp which rigidly holds the core box during blowing. Sand is fed into the storage hopper and falls directly into the sand reservoir. In operation the clamping of the box takes place, followed by the movement of the sand reservoir over the core box and then instant blowing. By reversing the control, the sand reservoir moves back into its first position under the sand hopper to receive a fresh supply of sand, the core box is released and the finished core removed. The cycle of operations takes roughly ten seconds. The core-box clamp is readily adjustable to suit different sizes of core box. Since the blowing takes place at a uniformly high pressure, the cores produced are of consistent density.

Two sand and shot-blast machines are shown, the more interesting one for foundry practice being a medium shot-blast cabinet. This is the standard type of general purpose cabinet for all classes of castings. The bottom valve below the pressure appliance is accessible and readily renewable. Electric heating strips minimise the liability of the abrasive to rust. The control of blasting, starting and stopping, is by foot pedal which effects the admission of air from supply line, the closing and opening of valve between abrasive storage hopper and pressure appliance, and the opening and closing of abrasive regulating valve. The screen filter with motor driven dust exhaust pan is built integral with the cabinet, thus forming a self-contained unit. Continuous removal of the dust-laden air is maintained and ensures visibility within the cabinet. Only cleaned air passes to the pan and no perceptible dust is discharged to atmosphere. The nozzle may be fixed or portable inside the cabinet, or portable projecting through the front or side.



A—Wire mesh screen; B—Welded tube angle frame; C—Electric vibrator; D—Silentbloc bearings, and E—Cable to plug.

FIG. 7.—PORTABLE ELECTRIC VIBRATORY RIDDLE BY STONE-WALLWORK, LIMITED.

Finally there is a shot-blast barrel arranged with a pressure appliance as in the cabinet type, with single control to start and stop blasting. The barrel proper consists of a double casing made of suitable steel plate. The outer casing is conical, the inner casing being cylindrical and perforated. With this arrangement, the used abrasive falls into the annular space between the two casings and thence through the totally enclosed trunnion to the cleaning box at one end of the barrel. This meets the serious objection of dust and abrasive coming into contact with the rollers carrying the barrel, and hence eliminates the severe and costly wear. Before passing to the pressure appliance for re-use, the abrasive is screened, the tailings being abstracted, while the abrasive then passes to an air washer in which, falling over a cone, it is distributed in the form of a circular curtain through which suction air is drawn, carrying away the dust to exhaust. By this means only clean abrasive is re-delivered for use again. The pressure appliance is arranged with all parts accessible, and the connecting abrasive pipe supplies a continuous stream of abrasive to the nozzle which projects at the correct angle through the end of the barrel.

Foundry Exhibition

Coating Patterns

(*Stand No. K.*13)

The Metallizing Equipment Company, Limited, Victoria Street, London, S.W.1, show a metal spraying gun having interesting foundry applications. Readers can bring their own wooden patterns for a metallic coating. It is claimed that blow holes can be filled up with matching metals, and if the machine shop has taken over too much from a flange, the metal can be replaced.

Nickel Research

(*Stand No. G.*2)

The extensive advisory and research services of the development and research department of *The Mond Nickel Company Limited* are the theme of the company's stand. Many years of research conducted by the nickel industry on a world-wide scale have resulted in the accumulation of a vast amount of technical data on the properties and applications of nickel and nickel alloys. The full extent of the services available to the engineering world may not be fully known, and for this reason this stand has been planned to draw attention to the facilities offered.

These services are provided by means of reports and correspondence, personal visits and practical advice rendered on the spot, covering every stage from the choice of material by the designer through the various production and fabrication processes to investigation of service requirements and conditions. Members of the technical staff will be present at the Exhibition to assist visitors who have metallurgical problems, and will welcome the opportunity of discussing the improvements in technique and materials developed to meet war needs which are now available for post-war industrial development.

Melting Furnaces

(*Stand No. G.*15)

Monometer Manufacturing Company Limited, Savoy House, 115-116, Strand, London, are showing a comprehensive range of melting furnaces for all metals arranged for gas or oil firing, as follow:—A 600 lb. "Monometer" preheated-air central axis tilting crucible furnace, for the melting of all non-ferrous metals. The tilting is effected by totally enclosed oil-immersed gears. This represents a range of six sizes, the smallest being 250 and the largest 1,500 lb. brass capacity. Also for non-ferrous melting there is a 1-ton capacity non-crucible semi-rotary tilting furnace. For melting bearing and whitemetal alloys there are a 1-ton and ½-ton capacity valve-outlet furnace and a ladling furnace. A 150-lb. capacity preheated-air bale-out melting furnace is shown for melting aluminium and all light alloys. Finally there is a general purpose "Monometer" 160-lb. lift-out crucible furnace.

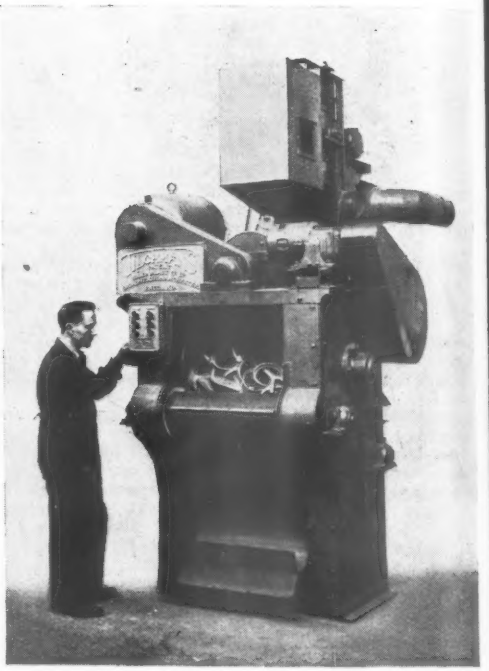


FIG. 8.—TILGHMAN'S WHEELABRATOR "TUMBLAST" CLEANING MACHINE.

Crucibles

(*Stand No. C.*13)

The Morgan Crucible Company Limited, of Battersea, exhibit a wide range of crucible melting plant, including the following:—

Lift-out furnace.—This is a typical general purpose melting unit for handling a variety of small charges in the foundry with efficiency and economy. It is very useful for the jobbing foundry where a flexibility of melting plant is needed. Its chief advantage over the conventional pit type is that it is low enough to be installed standing on ground level or in a shallow pit; installation costs are therefore small. The furnace top and operating controls are at easy working level, making working conditions clean and comfortable.

Bale-out furnace.—These melting and maintaining crucible furnaces are in general use, mainly for aluminium die-casting. They may be used for melting scrap and ingots or for maintaining at the required casting temperature molten metal received from tilting or lift-out furnaces. The metal is melted out of contact with the furnace waste gases, thereby avoiding

oxidation losses and yielding castings free from gas and other contamination. The furnace is arranged to give maximum comfort to the operator—the top is closed in, the waste gases exhaust from a side flue away from the operator, and the furnace is well insulated.

Tilting crucible furnace—central axis pour.—This type (one of which is illustrated in Fig. 4) are the simplest and most inexpensive of tilting furnaces. They tilt about an axis passing through the centre of the furnace body, which is, therefore, practically self-balancing. These furnaces are the most popular for general foundry use; they are quickly and easily installed by bolting to the foundry floor. The low-pressure gas burner tilts with the furnace and can be fired during the pour; the oil burner also tilts with the furnace in models up to ¾-ton capacity.

Hydraulic tilting crucible furnace (lip pour).—This is designed with the tilting axis passing through the pouring point so that a steadily positioned stream of metal is maintained throughout the pour. It is, therefore, especially useful for casting strip, billets or ingots direct from the furnace without the use of a ladle. The furnace body is not counter-balanced, but is driven up by a telescopic ram served by a motor-driven pump and reservoir housed under the furnace platform. The body lowers under its own weight. Burner control (in the case of oil or gas), tilting control, and charging platform are conveniently grouped, and the finger-tip tilting control, incorporating an on-off push-button for the motor, is placed to give the operator a full view of the pour. Pouring control is so positive that fine strip mould can be poured direct.

A new rotary crucible furnace has been designed to eliminate the difficulties attached to swarf and metal powder melting. Fitted with a specially designed, bottle-shaped crucible, the furnace body is tilted in operation to an angle of 45 deg. and is continuously rotated while firing. The oil or gas burner fires downwards through the stationary cover. The rotation coupled to the bottle shape of the crucible continuously turns the swarf or metal powder over, dipping it repeatedly into the molten pool as the charge melts.

Morganite carbon moulds and cores are made from a material which has an extremely low and reversible coefficient of expansion, together with a high heat transfer, and has obvious advantages for mould work. Carbon is not wetted by molten metal and is non-contaminating. Among the moulds and cores on view is a large mould—27 in. high × 9½ in. square—for casting alloy steel. The "Triangle" pure oxide ware shown is characterised by chemical purity and inertness. It is highly refractory and has a good resistance to glasses, slags, and carbonaceous and hydrogen atmospheres. Tensile and compressive strengths are good and so is resistance to abrasion. Electrical resistivity is of a high order. "Triangle" ware in pure alumina, magnesia and beryllia is employed in the ceramic, metallurgical and allied industries. It is invaluable alike for research, development and production. Naturally, a range of crucibles, basins and other plumbago products have been included in the exhibits.

FIG. 9.—CORE-SAND MIXER EXHIBITED BY THOS. W. WARD, LIMITED.

Magnetic Equipment

(*Stand No. G.*16)

The Rapid Magnetting Machine Company Limited, Lombard Street, Birmingham, are showing various types of their specialised magnetic equipment which is widely used in connection with purification, extraction, reclamation, protection, and transportation problems. Magnetic equipment is widely used in foundry practice for ridding sand of tramp iron, especially in mechanised systems. Slips for vitreous enamel are also systematically purified by electro-magnetic treatment. The scrap yards of most of the larger foundries are served by electromagnets attached to either overhead or jib cranes.

Sand Testing

(*Stand No. C.*14)

Ridsdale & Company, Limited, of 234, Marton Road, Middlesbrough, show all latest apparatus for sand testing. Among new features exhibited is the Dietert design of A.F.A. drop rammer, with the attachment for indicating the desnity of the sand as described by the H. W. Dietert Company in the FOUNDRY TRADE JOURNAL some weeks ago. Then there is the B.C.I.R.A. green bond strength machine, which is fitted with a special attachment for measuring yield point of green bonded sands. The Coombs gyratory sifter has been modified to take the latest B.S.I. nest of sieves, which are approximately 2 in. deep instead of the shallower sieves formerly supplied. A new laboratory core oven fitted with revolving shelves (detachable) and thermostatically controlled, has been recently re-designed to give maximum efficiency.

Foundry Exhibition

Moulding Boxes

(*Stand No. D.*12)

Sterling Foundry Specialties Limited, Sterling Works, London Road, Bedford, are exhibiting samples of their moulding boxes, which are used in most of the principal foundries in the United Kingdom and the U.S.A. for steel, iron, and all types of non-ferrous work. They are also showing one of their shakeout machines, of which well over 100 are in operation in this country at the present time. This machine was developed during the war and is being shown for the first time.

Pig Iron

(*Stands F.*4 *and E.*16)

Stewarts and Lloyds Limited are showing a selected range of their products along with those of an associated company, the *Lancashire and Corby Steel Manufacturing Company Limited*. In the Foundry Trades section they show a comprehensive selection of foundry and basic pig irons, ganister, limestone, billets, blooms and rounds, steel castings, and hot and cold rolled steel strip, as well as examples of their steel and tube works' by-products.

Moulding Machines

(*Stand No. H.*21)

As manufacturers of all types of equipment required in connection with the mechanisation of foundries, *Stone-Wallwork, Limited*, 157, Victoria Street, London, W.1, are exhibiting four models from their range of moulding machines. All models exhibited incorporate their well-known patented shockless jolt squeeze mechanism, and are fitted with Stone-Wallwork Aerox air filters ensuring a supply of air to the machines free from moisture and grit. The models shown are as follows:—(1) Pair of type WT.563 straight draw moulding machines, automatically controlled by means of cam-operated valves, leaving the operator only to fill the moulding boxes with sand, press a push-button switch, and remove the finished moulds; (2) type WT.562AY turnover moulding machine (Fig. 5) incorporating a new type of "air-on-oil" turnover unit—the machine coupled with a straight draw machine, similar to the type WT.563 exhibited, makes an ideal mould-producing unit, and (3) type WT.547 snap flask moulding machine (Fig. 6). The firm is also exhibiting two electric vibratory riddles, one being the portable type (Fig. 7) and the other suitable for fitting adjacent to a straight draw machine. Unfortunately, due to the limitations of space, it is not possible for the firm to show other than by means of photographs the extensive range of equipment which they manufacture. These photographs show their installation of complete sand conditioning plant, dust extraction equipment, conveyors, etc. The stand is primarily that of the Foundry Equipment Division, but there are exhibits displayed by the Gear Division which include H.R. and Wallwork reduction gears and the P.I.V. variable speed gear.

Shot Blasting

(*Stand No. E.*15)

Tilghman's Patent Sand Blast Company Limited, Broadheath, near Manchester, have devoted the whole of their stand to exhibiting various types of plant concerned with shot blasting. This is a specialised line in which much progress has been made during the war years. Of outstanding interest, because of its wide industrial application, is the smallest size of Wheelabrator airless Tumblast (Fig. 8). A quite new machine, the Wheelabrator swing table, is being shown for the first time. The exhibit also includes a Tilblast cabinet utilising the wet process.

Foundry Equipment and Supplies

(*Stand No. F.*14)

Thos. W. Ward Limited, Albion Works, Sheffield, are exhibiting in the category of the following:—Foundry plant and equipment; crucible furnaces; tilting furnaces; mould driers; sand mixers; screens and riddles; mixer-millers; sand conditioning plant; foundry ladles; and moulding boxes. In the foundry supplies section there are pig irons (foundry, forge, basic, hematite, low phosphorus and refined); Priestman foundry cokes (beehive and patent oven); Mansfield Red moulding sand; ganisters, limestone and fluorspar; refractories, blast-furnace coke, cinder and millscale, and the like. Most of the foundry plant shown is the Polford make, and the illustration (Fig. 9) shows a core sand mixer, made in three sizes, 1, 3, and 5 cwt. capacity.

Nickel Alloys

(*Stand No. G.*2)

For many years, *Henry Wiggin & Company Limited* have specialised in the production of high-grade nickel alloys in the forms required by industry. The alloys exhibited on their stand at this Exhibition will be of interest from many aspects of engineering, particularly those involving resistance to heat and corrosion.

Among the more important exhibits are the Nimonic series of alloys. These high temperature materials, best known for their contribution to the development of the gas turbine in this country, are seen in the representation of a turbo jet, which includes part of a turbine rotor, with the turbine blades in position, and flame tubes. The turbine blades are made in Nimonic 80, and the parts subjected to the highest temperatures in the flame tubes are fabricated from Nimonic 75 sheet. Interest will be taken in the wide range of corrosion-resisting materials on view, including Monel, pure nickel and Inconel.

Pig Iron

(*Stand No. E.*17)

While the *Workington Iron & Steel Company Limited* (*Branch of the United Steel Companies Limited*) show samples of their hematite, "UCO" refined cylinder, and "UCO" refined malleable irons all as machine-cast pigs, they have utilised castings made by their customers to indicate variety of application. Technicians are available for consultation.

Graphite Formation in Grey Cast Iron*

By H. Morrogh and W. J. Williams
(British Cast Iron Research Association)

(*Continued from page* 363)

The Anomalies of Graphite Formation

Undercooled Graphite. So far, reference has been made solely to the flake graphite structure, the appearance of which is very familiar to all metallurgists dealing with cast iron. It has been shown that a rudimentary explanation can be given of the mechanism of the solidification of irons having these structures. However, equally well known is the fact that the graphite in cast iron may occur in a different pattern which has a distinctly eutectic-like appearance and which has been variously described as supercooled, undercooled, reticular, eutectic, etc. The present Authors prefer the term "undercooled" to indicate this form of graphite. Both flake graphite structures and undercooled graphite structures have been very thoroughly illustrated in the literature and further illustration here is superfluous. The factors promoting the formation of undercooled graphite structures are fairly well known, but the fundamental reasons for their occurrence is not understood.

Rapid cooling is known to promote the formation of undercooled graphite and so it tends to occur most readily in thin sections, at cast surfaces, near chills and in castings made in permanent moulds of high thermal conductivity. Rapid cooling is not, however, a necessary condition for its formation and it may occur even in very slowly cooled castings. Furthermore, it may occur intimately mixed with flake graphite structures. Usually when the two forms occur together, the under-cooled graphite is at the centres of the eutectic cells with the coarser flake graphite at the peripheries of the cells. In these cases it would seem that the undercooled graphite derives from the first eutectic to solidify. Occasionally, patches of undercooled graphite are found in the centre of a section, that is, in the most slowly cooled zone, when the remainder of the section has coarse flake graphite. Whilst flake graphite structures and undercooled graphite structures occur with a wide range of size for the individual graphite particles or flakes, there appears to be a fundamental difference in the two patterns even when in each case the graphite particles approach the same order of size. In general, however, the graphite size in undercooled structures is much finer than that in flake structures for equal rates of cooling.

Undercooled graphite structures have been produced and recorded by many investigators, and individual reference to all cannot be made here. It was observed and confirmed by many that superheating of the melt favoured the formation of undercooled graphite, particularly when the superheating was carried out in a crucible or electric furnace. Norbury[10] showed irons giving undercooled graphite structures to have a greater tendency to chill than irons giving flake graphite structures, and also that the eutectic arrest for fine graphite irons took place at a lower temperature than that for flake graphite irons of similar composition.

Norbury and Morgan[11] showed that an iron normally solidifying in a given section to give coarse flake graphite could be made, by the addition of titanium in a suitable form to the melt, to yield undercooled graphite. They also found that this effect of titanium could be considerably enhanced by bubbling carbon dioxide through the melt before casting. Subsequent experience of these investigators at the laboratories of the British Cast Iron Research Association showed that the apparently inherent tendency of some pig-irons to give undercooled graphite structures on remelting could be explained by the presence of titanium in these pig-irons. The same investigators also found that by bubbling hydrogen through the melt before casting coarse flake graphite structures could be produced when otherwise undercooled graphite structures would have been obtained.

In irons of normal nitrogen content and containing sufficient manganese to balance the sulphur content, any excess of titanium over that required to neutralise the nitrogen as titanium cyanonitride occurs as titanium

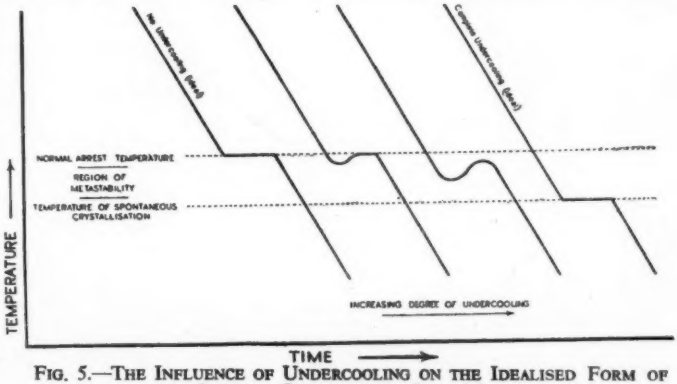


FIG. 5.—THE INFLUENCE OF UNDERCOOLING ON THE IDEALISED FORM OF THE COOLING CURVE FOR A PURE METAL.

* Paper presented at the Nottingham Conference of the Institute of British Foundrymen.

Graphite Formation

carbide. The present investigators find that unless some of the titanium is in the form of titanium carbide, no refining action is obtained. The present investigators have also found that zirconium has a similar influence to that of titanium provided some of the zirconium is in the microstructure in the form of zirconium carbide. The similar influences of titanium and zirconium are not surprising in view of their chemical similarity.

Von Keil and his co-workers[12] have suggested that a sub-microscopic silicate-slime nucleates the melt to give coarse flake graphite, and that the absence of these fine particles permits the formation of undercooled graphite. Norbury and Morgan postulated a similar theory to explain the effects of titanium and carbon dioxide, by which it was suggested that this treatment converted solid inclusions to a liquid form which could not nucleate the melt. The silicate-slime theory has received support from the work of Diepschlag,[13] who found that melting in contact with aluminous slags had a graphite-refining effect, and melting in contact with siliceous slags had a graphite-coarsening effect. Here it is interesting to note that Bardenheuer and Reinhardt[14] found that melting under mill-scale tended to produce flake graphite and that melting under glass tended to produce undercooled graphite. Attempts to confirm the findings of these German investigators have failed, but slag composition does undoubtedly influence the chilling characteristics and graphite size of cast iron.

Considerable difficulty has been experienced in advancing the silicate-slime theory further, owing to the difficulty of establishing the identity of the particles necessary for the theory. Microscopically, cast iron is characterised by the almost complete absence of visible oxides and silicates, except in the case of mechanically entrapped slag.

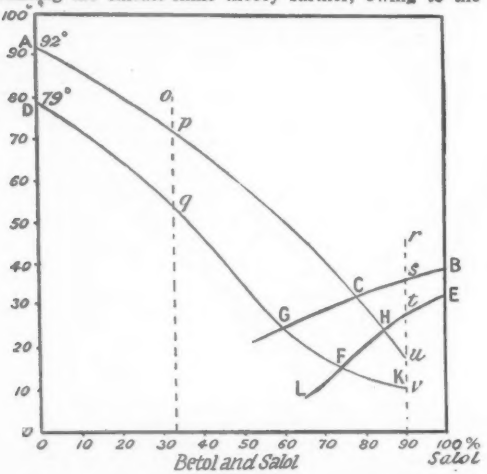


FIG. 6.—THE SYSTEM BETOL-SALOL, SHOWING SUPER-SOLUBILITY CURVE. (FROM DESCH, AFTER MIERS AND ISAAC.)

Inoculation

By practical experience it was eventually found by many investigators that undercooled graphite structures were undesirable in high-duty cast irons, particularly when some degree of shock-resistance was required. This, not unnaturally, led to the development of processes aimed to eliminate the formation of undercooled graphite. This was achieved by a procedure now referred to as "inoculation," and which involved the treatment of the melt with a relatively small amount of a substance, generally a graphitiser, immediately before pouring. Added in this way inoculants usually have a graphitising influence much greater than if they are included in the melting stock along with the other material. In general, the function of an inoculant is twofold—it eliminates the possibility of undercooled graphite forming, giving flake graphite instead, and it reduces the tendency for an iron to chill.

This latter effect may be the outcome of the first. Many inoculants have been used commercially, and among the most well known are calcium silicide, ferro-silicon, silicon carbide and graphite. Various proprietary graphitising inoculants have been developed, and perhaps the best known is S.M.Z.[15] This is a silicon-manganese-zirconium alloy containing approximately 63 per cent Si; 6 per cent. Mn; 6 per cent. Zr, and 20 per cent. Fe. The precise function of the deoxidising elements, manganese and zirconium, is not understood, but the addition does in general give better results than an addition of ferro-silicon, giving the same yield of silicon to the metal. Significantly, however, the performance of ferro-silicon as an inoculant can be improved both from the point of view of chill removal and resultant mechanical properties by mixing with aluminium turnings,[16] and one of the present investigators finds this combination even more efficacious than S.M.Z. It should be noted that the simultaneous addition of aluminium and ferro-silicon has been known to give, for reasons not yet apparent, castings with large numbers of blowholes. A feature of the inoculating process is the fact that the effect tends to disappear by holding the treated metal for long periods in the molten condition, and it disappears completely on remelting, giving normal chilling and undercooled graphite structures.

Small additions of certain elements, when added to the molten metal immediately before casting, produce a profound reaction in the tendency to chill without necessarily removing undercooled graphite structures. Typical examples of this are the elements aluminium and titanium. It has been suggested that this effect of these elements is due to their deoxidising properties, but no experimental evidence has been forthcoming to substantiate this view.

Undercooling of Cast Irons

It has been demonstrated by many investigators that the eutectic arrest in irons yielding undercooled

FIG. 7.—LARGE FLAKES OF KISH GRAPHITE AT BOTTOM OF INGOT MELTED IN GRAPHITE CRUCIBLE IN VACUUM. THE EUTECTIC GRAPHITE IS FLAKE. ETCHED IN PICRIC ACID. × 60.

graphite structures takes place at a lower temperature than the corresponding arrest in flake graphite irons. This fact, coupled with the formulation of the nuclei theories of Von Keil and Norbury and Morgan, led gradually to the suggestion that the flake graphite structures arose from solidification occurring according to stable conditions and the fine undercooled graphite arising as the result of undercooling made possible by the absence of sufficient or appropriate nuclei. Thus far the undercooling theory seems, in the light of subsequent work, to be largely correct, but many points still remain to be explained.

It is convenient here to consider briefly the background from which the undercooling theory was evolved. It is a well known fact that pure substances (including pure metals and alloys) can be made, on cooling from the liquid state, to undercool the normal freezing point until a point is reached when crystallisation suddenly begins and the temperature may rise rapidly as a result. The influence of undercooling on the idealised form of the cooling curve of a pure metal is illustrated in Fig. 5. Undercooling may be prevented or minimised by agitation of the melt or by nucleating the melt with solid particles, which may be of the same, or of a different, composition from the melt. It has been shown that, for solutions, the area below the normal solubility curve may be divided into two zones.

When the liquid undercools to a temperature immediately below the normal solubility curve the supersaturated liquid will not crystallise spontaneously. but nucleation is necessary to initiate the process. At a certain fixed temperature below the solubility curve, a point is reached when spontaneous crystallisation occurs without nucleation. For binary systems, it is frequently possible to draw a curve indicating the temperatures of spontaneous crystallisation for various compositions. This curve is referred to as the supersolubility curve. For eutectiferous systems our fundamental knowledge on this subject derives from this work of Miers and Isaac,[17 18] who studied undercooling in the simple eutectic system formed by the two organic compounds, betol and salol. Desch[19] has suggested that the fundamental principles shown by Miers and Isaac may be applicable to metals and alloys, and Gayler[20] has been able to determine the supersolubility curve for the eutectiferous aluminium-silicon system, and which incidentally shows undercooling characteristics which bear close similarity to those obtaining in cast irons.

The diagram giving the normal and the supersolubility curve for the betol-salol system is shown in Fig. 6. Curve ACB is the normal liquidus and curve DFE is the supersolubility curve. Desch has given a lucid account of the several ways in which solidification may proceed in such a system. These may be summarised as follows:—

For mixture with composition O:

1. p to C (normal solidification).
2. with solidification from q to F (the hypertectic point).
3. p to H, H to F.

These types are derived from the betol-rich side of the eutectic but similar types may be derived from the salol-rich side.

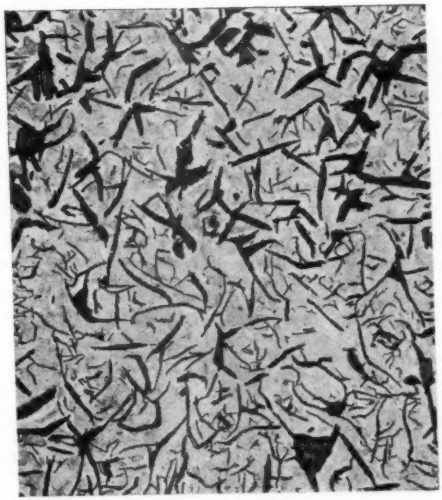


FIG. 8.—SEGREGATION OF KISH WITH FLAKE GRAPHITE IN UPPER PARTS OF VACUUM-MELTED INGOT. ETCHED IN PICRIC ACID. × 60.

Graphite Formation

It is possible to apply a generalisation of undercooling of this type to cast irons, particularly if they are considered as pseudobinary alloys. (It is realised that consideration of cast irons according to a binary diagram is fundamentally incorrect, but if this is borne in mind the following points can be made more simply without serious fallacy.) Fine undercooled graphite structures in hypoeutectic cast irons would then be obtained by undercooling to the supersolubility curve for austenite, austenite would be deposited until the hypertectic point was reached, at which fine undercooled graphite would form (Type 2). Alternatively, austenite could form following the normal liquidus. undercooling with the deposition of austenite could occur beyond the normal eutectic until the supersolubility curve lying below the hyper-eutectic liquidus was reached, the hyper-eutectic phase would then be deposited until the hypertectic point was reached, at which fine undercooled graphite would form (Type 3 This latter mode would involve the simultaneous appearance of both austenite dendrites and primary or kish graphite in the microstructure of irons of hypo-eutectic composition.

Thc present authors have never observed these two phases present in such irons and it seems doubtful whether such undercooling can occur. However, the analogue of this (Type 3) undercooling may occur in the case of hyper-eutectic irons. Frequently it has been observed by the present authors that austenite dendrites and kish graphite occur together in irons of hyper-eutectic composition having also fine undercooled graphite. Nipper[2 3] has also shown photographs illustrating this phenomenon. An interesting example obtained by the present investigators is illustrated in Figs. 7, 8 and 9. A small sample of pig iron was melted in a graphite crucible and superheated until saturated with carbon at a temperature of 1,650 deg. C. The melt was conducted in a high degree of vacuum. The resulting ingot was sectioned vertically.

Fig. 7 shows long flakes of kish graphite attached to the bottom of the crucible. In this zone these flakes of kish graphite had apparently inoculated the melt, preventing the formation of undercooled graphite. In the upper parts of the ingot a segregation of kish had occurred as a result of flotation from the central zones and again no undercooled graphite had formed (Fig. 8.) In the central zones, where little or no kish remained, undercooled graphite had formed and transformed austenite dendrites may be seen (Fig. 9). This melt had been saturated with carbon at the superheating temperature and it is difficult to see how these austenite dendrites could have formed except by undercooling of the Type 3 instanced for betol and salol in the foregoing. Reference will be made to Fig. 9 again in a later section of the paper.

Inoculation with Graphite

In the preceding section an illustration has been given of the inoculating effect of graphie. That this phase should cause inoculation of the melt is not surprising

FIG. 9.—UNDERCOOLED GRAPHITE AND TRANSFORMED AUSTENITE DENDRITES IN CENTRAL ZONES OF VACUUM-MELTED INGOT. ETCHED IN PICRIC ACID. × 60.

and the solution of graphite nuclei has been suggested as the mechanism responsible for the production of undercooled graphite by superheating[21]. This idea has received support by some investigators[22], but it has also been shown that graphite dissolves very readily[23] even at relatively low temperature in hypo-eutectic irons. Additions of graphite to a melt immediately before pouring have a powerful chill-removing influence. As an elaboration of the graphite nuclei theory, it has been suggested[24] that the function of calcium silicide and ferro-silicon in inoculating a melt is the production of momentary local concentrations of silicon which cause the precipitation of kish graphite, the persistence of which is ultimately responsible for the nucleation of the melt.

The present investigators wish to point out that this theory should indicate any element which reduces the carbon content of the eutectic to have an inoculating influence. Phosphorus, for instance, has roughly the same influence as silicon on the carbon content of the eutectic, but after many attempts the present investigators have so far been unable to produce inoculation by an addition of phosphorus or ferro-phosphorus.

Influence of Sulphur

The influence of sulphur in cast irons is probably very complex and reference can only be made to the general trends in the observed influence of this element. Boyles[25 26 27 28] has shown that cast irons differ fundamentally from simple ternary iron-carbon-silicon alloys of otherwise high purity, in that the latter usually give undercooled structures as a general occurrence. This experimental evidence indicates that the sulphur in cast irons may be responsible for the frequent formation of flake graphite.

Influence of Gases

Norbury and Morgan[11] demonstrated that treatment of a melt with hydrogen resulted in coarse flake graphite. The effect of hydrogen could be eliminated by subsequently bubbling carbon dioxide through the melt and furthermore it was found that the influence of hydrogen would disappear by holding the metal molten for a lengthy period after treatment with this gas. These findings were largely confirmed by Boyles,[25 26 27 28] who was also able to confirm the findings of previous investigators that melting in vacuum have undercooled graphite structures in hypo-eutectic irons and that the same structures could be obtained by melting in carefully dried air or nitrogen. No satisfactory explanation has yet been produced for the influence of these gases upon the graphite structure of cast iron.

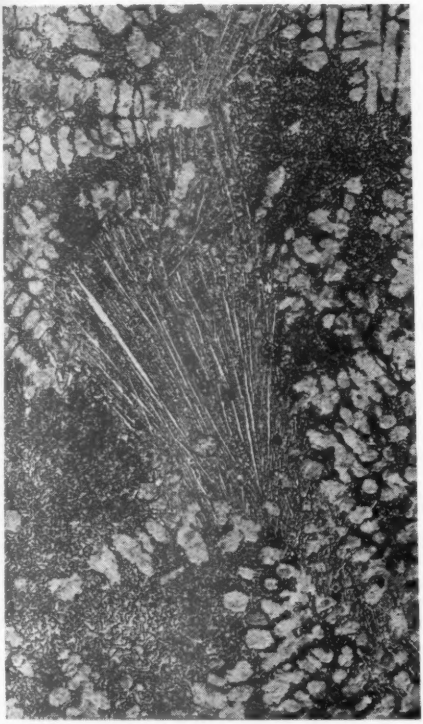


FIG. 10.—INVERSE CHILL IN AN IRON WITH UNDERCOOLED GRAPHITE. NOTE THE ACICULAR FORMATION OF THE WHITE IRON. THE REMAINDER OF THE STRUCTURE IS UNDERCOOLED GRAPHITE IN A MATRIX OF PEARLITE. ETCHED IN PICRIC ACID. × 60.

FIG. 11.—STRUCTURE OF SLOWLY COOLED INGOT QUENCHED IMMEDIATELY AFTER SOLIDIFICATION. SHOWING TRANSFORMED AUSTENITE DENTRITES AND WHITE IRON EUTECTIC OF ACICULAR PATTERN. ETCHED IN PICRIC ACID. × 60.

Formation of Undercooled Graphite

A considerable advance in the understanding of our mechanism of the formation of undercooled graphite was made when Eash[24] demonstrated that this form of graphite resulted as the solidification of white iron, the cementite of which decomposed after solidification. This investigator confirmed the finding of Boyles that flake graphite originating from the eutectic formed directly from the liquid metal. The present investigators considered the findings of Eash to be sufficiently important to check using somewhat different experimental procedure and at this stage it can be said that complete confirmation was obtained, as will be seen later.

Inverse Chill

Frequently castings are obtained which on fracturing show specks of white iron in the central zones of the fracture—this is usually described as inverse chill. This phenomenon is counter to normal experience, in that the carbide persists in the portions cooled more slowly, whereas carbide is usually obtained in the more rapidly cooled parts of a casting. This phenomenon should not be confused with that which is obtained when the sand mould causes inoculation of the surface layers of an otherwise white iron casting. The former appears to occur only when the grey portions of the casting have undercooled graphite structures.

Fractures showing this inverse chill give the impression at first that the spot of white iron is an

Graphite Formation

undissolved alloy addition. Examination under the microscope has revealed that the white iron of inverse chill possesses characteristic and easily recognisible features. Fig. 10 illustrates the typical appearance of the microstructure of inverse chill and it will be clearly seen that the carbide is arranged in an acicular pattern differing considerably from the normal eutectic structure of white cast iron. It will be shown later that this observation can be linked with the findings of Eash upon the mode of formation of undercooled graphite.

Confirmation of the Findings of Eash

Eash determined the cooling curves on bars 6 in. long and 1.2 in. diameter, cast in drysand cores with thermocouples inserted in the mould cavities. At the appropriate temperature after solidification the cores were broken open and the bars were quenched in water. This method obviously calls for considerable dexterity and the accuracy of fixing the actual quenching temperature is limited partly by the relatively rapid cooling rate of such relatively small sections. After many attempts to develop a satisfactory alternative technique, the present investigators finally used samples weighing about 6 gm. melted in small crucibles made of silica tubing. The melting and cooling was carried out in a platinum resistance tube furnace, so arranged that immediately after the completion of solidification the silica tube assembly could be plunged through the furnace bottom into a deep bath of water. The cooling rates used were equivalent to those obtained in sections greater than 3 in. when cast in sand moulds. The occurrence of undercooled graphite was made certain by the use of irons containing titanium. Medium and low carbon irons were investigated.

Preliminary experiments showed that good undercooled graphite structures were obtained when the ingots were allowed to cool slowly to room temperature. Ingots quenched immediately after solidification had a white iron structure, a typical example of which is illustrated in Fig. 11. In this case the eutectic arrest occurred at 1,133 deg. C. and the ingot was quenched at 1,132 deg. C. It is important to observe that, even though the ingot solidified at a relatively slow rate, the structure is that of a white iron and that the carbide is arranged in an acicular pattern which is very similar to that occurring in samples of inverse chill and illustrated in Fig. 10. Eash did not report the formation of this type of white iron structure. It would seem, therefore, that inverse chill occurs in irons, otherwise with undercooled graphite structures, because certain factors prevent the decomposition of the carbide immediately after solidification in the central parts of a section. The reason for this is not yet apparent.

(To be continued.)

A DELEGATION CONSISTING of six members of the Union de Fonderies Suisses de Métaux is to visit the Foundry Trades' Exhibition which opened to-day at Olympia.

Holding Loose Pieces

By "Checker"

Some method must often be applied when loose pieces have to be fixed in their correct position while the core is being made, to guarantee they will not be moved, but to nevertheless allow for an easy and quick release from the corebox before withdrawing the core from the box.

Fig. 1 gives an illustration of a simple but effective way of holding the loose boss which must be withdrawn through the side. It consists of a piece of ¼-in. dia. mild steel, the top being turned over 90 deg. to give a convenient hand grip when removing. When drilling the ¼-in. dia. hole for the peg, hold the loose piece in its correct position, and do not drill right

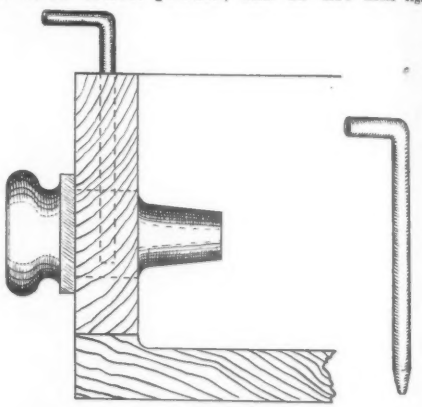


FIG. 1.

through the loose piece. This will save any inconvenience which would possibly arise through trying to place the round bar in position with the loose piece upside down, in which case the drilled hole in both corebox frame and loose piece would not be dead in line. It is an added advantage to taper the peg bottom to give it a good lead into the hole as shown on the right of Fig. 1.

On these types of loose pieces, a shoulder should always be made to act as a stop on the outside of the frame to prevent the loose piece being pushed too far into the corebox after removing the holding pin, while the shaped knob will give a good hold when removing it from the corebox side.

THE NEXT EXAMINATIONS for admission to the Institute of Marine Engineers will be held as follows:—Students, April 6 to 9 and October 5 to 8, 1948; graduates, May 24, 26 and 28, 1948, and associate members, May 24 to 31, 1948. Syllabuses of these examinations, copies of previous papers, and particulars of exempting qualifications will be supplied on application to the secretary, at 85, Minories, London.

July Iron and Steel Output

Target Prospects

Production of steel ingots and castings was at an annual rate of 11,007,000 tons in July, compared with 13,206,000 tons in the previous month and 11,759,000 tons in July, 1946. Output last month continued to be restricted by coal supplies, and was affected to an even greater extent than normal by the annual holiday arrangements, which this year tended to fall more than usual in July. Further, the new arrangement for six days' additional holiday with pay has to some extent increased the length of the holiday period this year.

Total steel production for the first seven months of the year up to the week ended August 2 amounted to 7,040,000 tons. To achieve the Government's target of 12½ million tons for 1947, production will need to be stepped up for the rest of this year to an annual rate of 13½ million tons. This expansion will largely depend on securing additional output of pig-iron. Two additional blast furnaces came into operation at the beginning of August and six further furnaces are planned to be blown in before the end of September. Two of these, one at Consett and one at the Colville works, are furnaces of the latest type, forming part of the modernisation programme on the blast-furnace side. This increase is dependent entirely on getting the allocated supplies of coke. It is hoped when the national holiday period is over that the expansion in coke supplies to the planned rate will be achieved.

Latest figures compare as follow with earlier periods:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1947—1st quarter	134,400	,989,000	216,000	11,231,000
2nd quarter	141,600	7,363,000	244,100	12,694,000
June ..	144,300	7,501,000	254,000	13,206,000
July ..	143,500	7,460,000	211,700	11,007,000
1946—1st quarter	145,500	7,566,000	242,600	12,617,000
2nd quarter	150,500	7,827,000	252,100	13,111,000
June ..	151,500	7,878,000	239,900	12,475,000
July ..	147,000	7,645,000	226,000	11,759,000

Record Output of Ironfoundries

The output of iron castings in the second quarter of this year amounted to 714,787 tons. which is equivalent to an annual rate of production of 2.86 million tons. This, according to the Council of Ironfoundry Associations, is the highest output which has ever been officially recorded. It has been achieved in spite of shortages of skilled labour and essential materials such as foundry pig-iron and cupola coke. If these handicaps could be removed, to allow the existing capacity of the ironfounding industry to be fully employed, even higher outputs could be reached.

New Blast Furnaces at Consett

Presiding at the annual meeting of the Consett Iron Company, Limited, Mr. Clive Cookson, chairman, said that good outputs had been achieved and sound progress made in new construction. Record weekly outputs were reached at the blast furnaces, in the melting shops, and in the plate and section mills. Substantial progress had been made at Consett with the erection and installation of new plant. Their second new blast furnace, to be known as No. 3, was almost completely erected and would be put into iron production shortly. An order had been placed for a third similar blast furnace, to be known as No. 1, in replacement of No. 8, the last of the old furnaces. Erection would commence early in 1948 and, when completed, they would have one of the most modern and efficient blast-furnace plants in the country, with a potential capacity of some 13,000 to 14,000 tons of pig-iron per week. Each of these furnaces would produce daily about 700 tons of pig-iron, which meant that each furnace had to deal with, and melt, each day about 1,700 tons of charged materials.

Hollow-ware Maximum Prices

The Board of Trade, in consultation with the Central Price Regulation Committee, have made an Order increasing manufacturers' maximum prices for cast-iron hollow-ware. The higher prices, which are due to increased labour and material costs, are set out in the schedule to the Order (the General Hollow-ware (Maximum Prices) (No. 3) Order, 1947, S.R. & O. No. 1716.) The Order also provides that manufacturers' maximum prices for hollow-ware made of electro-plated nickel silver, pewter, Britannia metal or electro-plated Britannia metal shall no longer be those ruling in August, 1943. Manufacturers' prices for these goods are now subject to the Prices of Goods Act, 1939, as amended, but distributors' margins remain unchanged. The Order will come into operation on August 18.

"Price Fixing" in U.S. Steel Industry

The Washington Federal Trade Commission has started an action against the American steel industry, accusing it of price fixing and "unlawful combination and conspiracy to throttle competition." It complains in particular of the "basing point" system of prices. which, it alleges, results in identical prices being quoted by all firms. The Commission has ordered the hearing of the action for September 19. The defendants are the American Iron and Steel Institute and all important steel producers.

Refractories Directorate

Mr. H. Halliday will relinquish his appointment as Director of Refractories in the Ministry of Supply on August 31. After that date, all communications and inquiries regarding refractory products should be addressed to the Ministry of Supply, Metals Division (M.2), Shell Mex House, London, W.C.2.

News in Brief

ON SEPTEMBER 1 NEXT, Philips Lamps, Limited, will change its name to Philips Electrical, Limited.

F. ISSELS & SON, LIMITED, of Bulawayo, Southern Rhodesia, are now manufacturing weaving looms. They are Meehanite licensees.

ALUMINIUM UNION, LIMITED, have returned to their former address at The Adelphi, Strand, London, W.C.2 (telephone: Temple Bar 3535).

JARROW METAL INDUSTRIES, LIMITED, iron and steel founders, of Jarrow-on-Tyne, have recently begun a new development in the manufacture of stainless-steel ship propellers.

MORE WOMEN WORKERS have been recruited by Blyth Dry Docks & Shipbuilding Company, Limited, of Northumberland. Girls are being employed as rivet catchers and older women as welders.

THE SOUTH AFRICAN FEDERATION OF ENGINEERING AND METALLURGICAL ASSOCIATIONS (S.A.F.E.M.A.) has changed its name to the Steel and Engineering Industries Federation of South Africa (S.E.I.F.S.A.).

TEN FIRMS have signified their interest in the re-allocation of surplus Government factories at Grantham occupied since 1945 by Grantham Productions, Limited. No decision is expected until the middle of September.

THE CITY ENGINEERING WORKS, LIMITED, of Pretoria, have started on the construction of new changing rooms, mess rooms, and pattern store to make space for new future foundry extensions. Foresight or *force majeure?*

VANDERBIJL ENGINEERING CORPORATION, LIMITED (Vecor), of South Africa, have taken over the old-established works of L. H. Marthinusen, of Johannesburg. Vickers, Limited, and Metropolitan-Vickers Electrical Company, Limited, have acquired a financial interest in Vecor.

NEGOTIATIONS between the Chainmakers' and Strikers' Association and the Chain and Anchor Manufacturers' Association, in regard to an application for an increase in wages, have resulted in a 10 per cent. unconditional increase in the price lists dated July 3, 1944. This will make a total increase of 17½ per cent. on those price lists.

AT A RECENT MEETING of the Halesowen Town Council, the Highways and Town Planning Committee recommended that permission be granted, subject to the alterations being carried out in a satisfactory manner, to Joseph Bloomer & Sons, Limited, chain manufacturers, of Cradley, Worcs, to commence foundry work at their existing premises.

MR. ERNEST V. PEARCE, chairman of Consolidated Tin Smelters, Limited, states in the annual report that a world price for tin can be established "only by creating a free market and allowing the forces of supply and demand to operate." The medium through which this could, and should, be done is the London Metal Exchange, and until this is again functioning producers the world over will remain dissatisfied and lacking in that incentive to production which a free market would provide.

Personal

MR. ERNEST JOYCE, of Stamford, Lincs, secretary of Blackstone & Company, Limited, engineers, has been appointed a director of the company.

MR. WILLIAM URE, of Falkirk, has been appointed organiser of the Amalgamated Union of Foundry Workers. He served during the war with the Argyll and Sutherland Highlanders, being engaged on intelligence and educational work.

DR. H. ROXBEE COX was recently decorated with the American Medal of Honour with Silver Palm at the American Embassy. The citation awards the medal to "British civilian Dr. H. Roxbee Cox, who rendered exceptionally meritorious service to the Government of the United States from September, 1941, to September, 1945, in connection with the development of turbo-jet and turbine aircraft engines. Dr. Roxbee Cox contributed to a great extent to the successful prosecution of this major war project by establishing and effectively administering an efficient system of technical collaboration between the British and United States Governments." Dr. Roxbee Cox is director of the National Gas Turbine Establishment at Whetstone, and chairman and managing director of Power Jets (Research & Development), Limited.

Wills

BETHELL, G. W., of Stockport, brassfounder £3,398

TINGLE, LEONARD, of Curbar, Derbyshire, steel manufacturer £5,512

HILL, HAROLD, of Totley, Sheffield, director of Ernest H. Hill, Limited, brassfounders £130,157

BEAUCHAMP, J. W., of Hampton Court, Middx, formerly of Nether Edge, Sheffield, first director of the British Electrical Development Association £7,101

STODDART, L. B., a director of C. T. Bowring & Company, Limited, exporters of iron and steel, etc., and Olympic Portland Cement Company, Limited £150,001

WILSON, J. W., of Dewsbury, Yorks, late chairman and managing director of James Austin & Sons (Dewsbury), Limited, iron and steel stockholders, etc. £46,076

MR. W. A. HAWKSWORTH, of Totley, Sheffield, a director of Wardlows, Limited, Sheffield, tool steel manufacturers, died recently. He had been with the firm for 55 years.

THE CAPITAL OF South Wales Switchgear, Limited, has been increased to £250,000 by the creation of 240,000 ordinary £1 shares. Recently the business was converted from a private into a public company.

THE AMERICAN IRON AND STEEL INSTITUTE report that wage adjustments which have occurred in the steel industry since the beginning of this year represent an addition to the payroll of approximately £71,000,000 over a period of 12 months. This total, it is pointed out, is equal to the net earnings of the entire industry in 1946, including non-steel making activities, assuming uninterrupted working schedules for a full year. To-day the hourly rate for the lowest paid workers in the industry is $1.09, equivalent to about 5s. 6d.

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REFINED PIG IRON
Manufactured to guaranteed analyses in seven standard grades. Also obtainable to individual specification
THE 17-TON CASTING ILLUSTRATED IS ONE OF A SERIES MADE IN A STANTON FOUNDRY FROM STANTON DALE IRON
1. Core being lowered into mould
2. Pouring the metal
3. Finished casting in transit
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STANTON IRONWORKS
COMPANY LIMITED
NEAR NOTTINGHAM

New Trade Marks

The following applications to register trade marks appear in the "Trade Marks Journal":—

"MAXOIL"—Oil extraction apparatus. ROSE, DOWNS & THOMPSON, LIMITED, Old Foundry, Cannon Street, Hull.

"ESPANDO"—Metal storage bins or racks. B. T. L. PRODUCTS, LIMITED, 7, The Parade, Hounslow West, Middx.

"PLESSEY"—Electrical apparatus and instruments. THE PLESSEY COMPANY, LIMITED, 56, Vicarage Lane, Ilford.

"MINDUS"—Electric motors. MIDLAND INDUSTRIES, LIMITED, Heath Town Works, Deans Road, Wolverhampton.

"TETT'S"—Water softening apparatus G. S. TETT & COMPANY, LIMITED, 32, Queen Victoria Street, London, E.C.3.

"HURLINGE"—Metal hinges. ERIC HURLEY & STANLEY BENSON CALDWELL, 129, Chester Street, Birkenhead, Ches.

"ROBSON"—Gas and oil engines. JOHN ROBSON (SHIPLEY), LIMITED, Alexandra Works, Ives Street, Shipley, Yorks.

"AJAX"—Gas cookers, fires, etc. SIDNEY FLAVEL & COMPANY, LIMITED, Eagle Foundry, Ranelagh Street, Leamington Spa.

"MAGCRATE"—Crates made wholly or principally of metal or metal alloys. ESSEX AERO, LIMITED, Queen Street, Gravesend.

"MEGATOR"—Pumps and compressors. MEGATOR PUMPS & COMPRESSORS, LIMITED, London Air Park, Feltham, Middlesex

"MEMCO"—Expanded common metal. MIDLAND EXPANDED METAL COMPANY, LIMITED, 202, Fazeley Street, Birmingham.

"CAMBERT"—Metal hollow-ware. WILBERT MOTOR & ENGINEERING COMPANY, LIMITED, 314, Balham High Road, London, S.W.17.

"SMITHS"—Metallic flexible tubing, etc. S. SMITH & SONS (ENGLAND), LIMITED, Cricklewood Works, Edgware Road, London, N.W.2.

"HOBWELA" and "HOBMOL"—Steel. CAXTON STEEL COMPANY, LIMITED, Park Royal Steel Works, Cumberland Avenue, London, N.W.10.

"METOLUK" AND DEVICE—Water supply and sanitary installations, etc. SHORT & HARLAND, LIMITED, Airport Road, Queen's Island, Belfast.

"TRONIX" (DEVICE)—Electrical instruments and apparatus, and insulated electric wire. FLOWERDALE, LIMITED, 16, Ogle Street, London, W.1.

TRIANGULAR DEVICE—Metal split heads. CHURCH HILL FORGE (MIDHURST), LIMITED, Station Works, Station Road, Norwood Junction, London, S.E.25.

"PLASTON"—Unwrought or partly wrought steel. CAXTON STEEL COMPANY, LIMITED, Park Royal Steel Works, Cumberland Avenue, London, N.W.10.

"OCTOPUS"—Variable speed gears, hoists, machine tools, etc. ARMATURE MANUFACTURING COMPANY, Rushbank Electrical Works, Burnley Street, Oldham.

"ST. JAMES IMMACULATE" (DEVICE)—Apparatus and installations for cooking and heating, etc. H. E. NEWHOLM & COMPANY, 98-99, Jermyn Street, London, S.W.1.

"V" AND CIRCULAR DEVICE—Silencers and silencing apparatus for machinery, for engines and for motors and filters. VOKES, LIMITED, Henley Park, near Guildford, Surrey.

"MARANDA"—Articles made of wrought iron, metal containers and metal crates, etc. M. R. D. A., LIMITED, Maranda House, Binney Street, Oxford Street, London, W.1.

Company News

(Figures for previous year in brackets.)

Bellis & Morcom—Net profit, £55,683 (£55,360); final dividend of 10%, making 14% (same).

Consett Spanish Ore—Interest, etc., received to June 30, £88 (£53); fees and other expenses, £116 (£120); loss, £28 (£67), reducing credit balance brought in to £3,701.

Davy & United Engineering—Net profit for the year ended March 31 last, £47,492 (£51,911), after fees, depreciation, taxation, and repairs; dividend of 7½% (same); forward, £98,135 (£76,527).

Fisher & Ludlow—Net profit for the year ended March 31, after depreciation, tax, etc., £141,983 (£125,438); to staff fund, £5,000 (same); dividend of 20% (15%); forward, £217,200 (£165,253).

Metal Traders—Net profit for the year ended March 31 last, after tax, £78,073 (£9,545, including £2,800 tax recoverable); final dividend of 212½%, making 250% (first and final payment of 37½%); forward, £127,492.

Davey, Paxman & Company—Profit for the year ended March 31, after charging depreciation, E.P.T., and profit tax, £69,925 (£61,904); income tax, £26,813; to general reserve. £25,000; to general contingencies reserve, £5,000; dividend of 10%; forward, £10,823 (£11,232).

Gazette

MACHINERY SUPPLIES (LEICESTER), LIMITED, is being wound up voluntarily. Mr. R. P. Gillett, 39, Friar Lane, Leicester, is the liquidator.

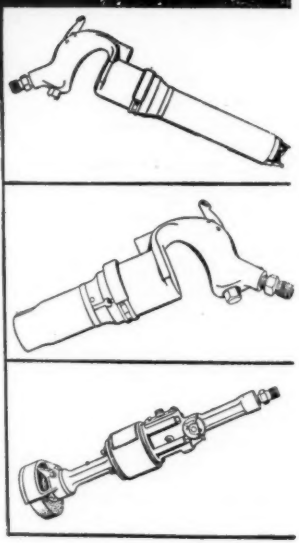
THE METAL HIGH SHINING COMPANY, LIMITED, is being wound up voluntarily. Mr. B. Myers, 34, John Dalton Street, Manchester, is the liquidator.

JOHN HILL & SONS (WOLVERHAMPTON), LIMITED, engineers, ironfounders, etc., is being wound up voluntarily. Mr. H. Brown, 16, Devonshire Road, Handsworth Wood, Birmingham, is the liquidator.

THE PARTNERSHIP BETWEEN Herbert Clegg Charnley and John Gordon Tyldesley, carrying on business as agricultural and general engineers at Rose Cottage, Little Stretton, Salop, under the style of Charnley & Tyldesley, has been dissolved by mutual consent. Debts will be received and paid by J. G. Tyldesley, who will continue to carry on the business under the style of J. G. Tyldesley.

SMITH'S DOCK COMPANY, LIMITED, North Shields, have received orders for four whale catchers for Buenos Aires owners.

World famous for their Riveting hammers, Holmans also produce a range of pneumatic tools. **Riveting Hammers.** The "X" series has long been the first choice for medium work. Now the "ER" group has been added to the range: the ER's are heavy duty tools capable of closing cup rivets of all sizes up to 1⅜ in. **Chipping & Caulking Hammers.** These are tools that all operators like to use and the full range enables the right tool to be used for the right job. The Throttle Valve gives full control of weight of strike from light taps to full force blows. The adjustable Exhaust Deflector and the sensible grip make for comfortable working. **Grinding & Fettling Tools.** The Rotogrind series gives a choice of tools with a wide variety of application. 0/1 is the high speed job. Its weight is 4 lbs. all on and it will rev up to 16,000 P.M. Its light weight makes it a first-class tool for such delicate jobs as die dressing and its power and speed make it suitable for much general purpose work. Sizes 2 and 4 will take any grinding or fettling work that comes their way, their power/weight ratio is very high and they are the ideal tools to carry fast cutting wheels. No: 5 is the Surface Type grinder and fettler, ideal for fettling large castings, and smoothing off welds:



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New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Rose Foundries, Clarence Wharf, Newport, Mon—£5,000. P. Caller and C. A. Rose.

Bradley & Salter—Engineers, etc. £5,000. W. E. Salter, Ashley House, Newnham-on-Severn, and H. G. Bradley.

J. J. Cuerden, Cable Street Mill, Preston—Metal and machinery merchants. £5,000. J. J. and H. S. Cuerden.

Downe & Baker, 77, South Street, Exeter—Brassfounders, etc. £3,000. D. and E. M. Baker, and A. W. F. Drake.

Riva Fireplace Company, Duke Street; Fenton, Stoke-on-Trent—Engineers, etc. £50,000. M. Crosbee and H. B. Simmonds.

Industries (Steel Plate & Steel Construction), Cradley Road, Netherton, Dudley—£1,000. J. W. Lacey, J. K. Cox, and A. Bate.

Bristol Steel Services, Bath Road, Brislington, Bristol —Engineers. £12,000. H. Hardwick, W. Richards, and V. W. Burrough.

Cobnor Engineering Company, 16, Heneage Lane, Leadenhall Street, London, E.C.3—£2,000. J. M. King and W. J. H. Lambert.

Henry Hirst & Sons, California Works, Oxford Road, Gomersal, near Leeds—Engineers, founders, etc. £5,000. C., J., and C. Thurman.

J. S. Drew—General engineers, etc. £2,100. J. S. Drew, 56, Haymill Road, Burnham, Bucks; J. J. Pollard, and G. S. Drew.

Etchells, Congdon & Muir, 25, Mill Street, Ancoats, Manchester—Engineers. £30,000. F. Muir, W. B. Armitage, and J. Congdon.

J. M. Shasha Engineering Company, Asia House, 82, Princess Street, Manchester—£5,000. J. E., E. J., and G. Shasha, and T. C. Clayton.

Seals & Containers, The Corner House, Himley, Staffs—Mechanical and general engineers, etc. £1,000. J. B. Bassil, G. A. and B. B. Jeffries.

J. Bonnett, The Garage, Church Street, Conisborough, Doncaster—Mechanical and electrical engineers, etc. £1,500. J. and H. Bonnett.

North & Jennings, 109, Durham Road, London, N.7—Mechanical, electrical and general engineers, etc. £2,000. F. G. A. North and L. H. Jennings.

S.C.F. Products, 65, Bridge Street, Pinner—Horticultural and general engineers, etc. £1,000. H. E. and D. V. Constantine, C. R. Failes, and C. Bone.

Auto-Projection Engineers, Hong Kong Extension Works, Exhibition Ground, Wembley—£1,000. H. J. and D. N. J. Cullum, J. R. Donnan, and C. Green.

Stewart Burns Engineering Company, Clober Works, Cloberfield, Milngavie—£15,000. C. A. Hepburn, J. D. Ross, D. M. Smith, J. S. Burns, and R. J. Manson.

Booth Developments, Neville House, Waterloo Street, Birmingham—Lock, latch and deadlock mechanism manufacturers, etc. £2,000. J. H. Booth and S. G. Morgan.

J. F. Ward (London), 37, Wharf Road, City Road, London, N.1—Manufacturers of metal goods, etc. £2,000. J. F. Ward, A. H. Tytherleigh, and T. G. Johnson.

Liverpool Engineering & Diecasting Company, Avonmore Avenue, Liverpool—£20,000. W. J. Humphreys, H. T. Hoggarth, W. I. C. McCallum, F. Fletcher, and R. Blacklin.

Upfold, Swift & Company, Yetson House, Ashprington, near Totnes—General smiths, blacksmiths, etc. £2,000. I. Deuchar, H. M. Swift, B. B. Jackson, and G. F. Upfold.

F. C. H. Church & Company, Britannia Works, Gourley Place, Tottenham, London, N.15—Toolmakers, diecasters, etc. £8,000. F. C. H. Church and A. A. Clapham.

Ernest Wilkes, The Foundry, Foundry Lane, Pelsall —Designers and manufacturers of machinery and machine tools, etc. £15,000. A. J. and C. A R. Turner, C. G. and D. B. While.

William Bradbury Developments, Richmond Chambers, Richmond Hill, Bournemouth—Constructors and manufacturers of machinery, etc. £1,000. W. P. Bradbury, A. E. Hand, and M. Horton.

Garston Manor, 20, Kinnerton Street, Wilton Place, London, S.W.1—Industrial and scientific research, etc. £43,000. C. B. Tuson, H. D. Murray, R. B. A. Dawborn and J. R. P. Postlethwaite.

Malley & Company, Finsbury House, Blomfield Street, London, E.C.2—Wholesale merchant for electrical and mechanical engineering supplies, etc. £1,500. A. Et. J. Malley, A. S. Gegg, J. Robinson, and C. E. Tidy.

L.M.F.A. Development, Bennetts Hill, Birmingham, 2—To promote the sale, use, production and distribution of aluminium, etc. Council: G. A. Woodroff, G. E. Roberts, J. F. Paige, W. S. Knight, L. R. Carr, E. L. Smith and N. D. G. Robertson.

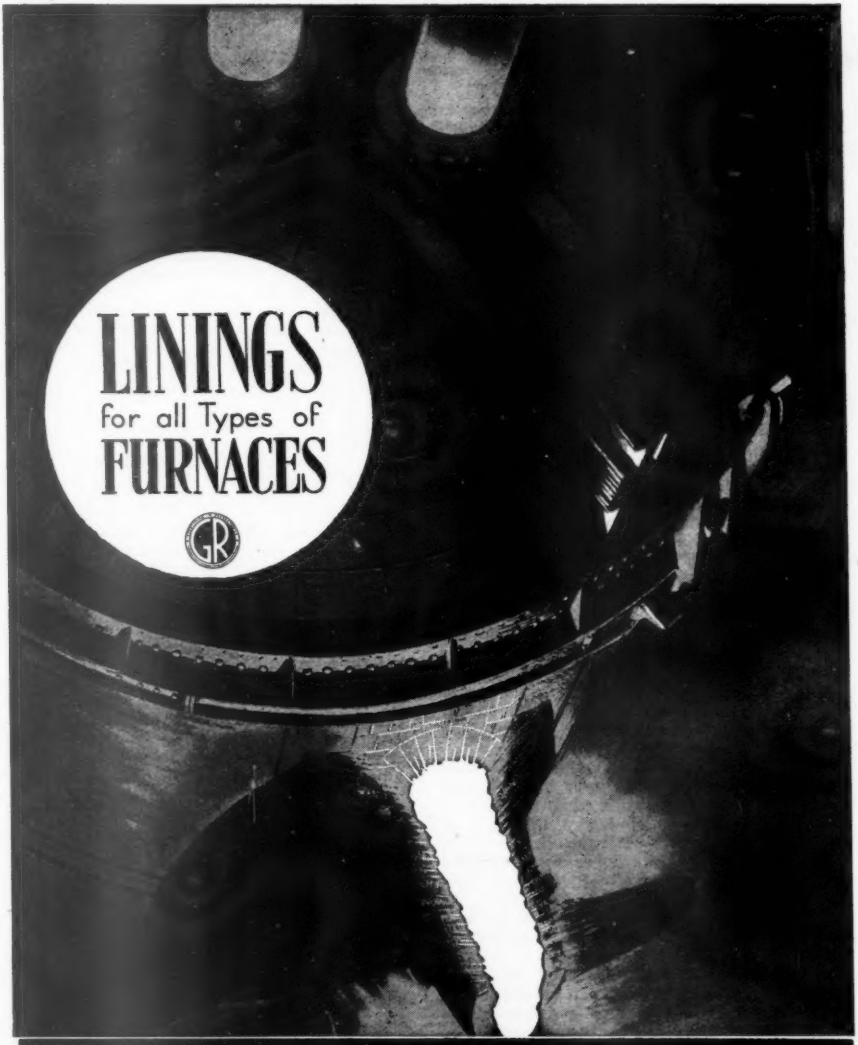
Pease & Partners Tees Foundries, 20-26, Northgate, Darlington—To acquire a certain part or department of the business and assets of Pease & Partners, Limited, £250,000. A. Whyte, W. Buchanan, R. C. Lodge, Sir R. A. Pease, and D. G. Pennington.

Contracts Open

The date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Plymouth, September 7—Founders' and smiths' materials and castings, etc., for the City Council. The Stores Officer, Corporation Stores Department, Mill Street, Plymouth.

Salisbury, September 13—Iron castings, etc., for the City Council. Mr. R. S. Little, city engineer, Council House, Bourne Hill, Salisbury.



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Raw Material Markets

Iron and Steel

It is much to be hoped that shortly arrangements can be made for stepping-up the production of foundry pig-iron, particularly high-phosphorus iron, which is largely produced by the Derbyshire and Northamptonshire furnaces and is used almost exclusively in the light-castings industry. Present output is scarcely sufficient for current production. It is important that the production should expand, as light castings are wanted in very large quantities for the building programme and for many other urgent purposes. There is also need for more low- and medium-phosphorus pig-iron. The general engineering and jobbing foundries are big consumers, and because of the stringency in the supply of these grades, they have had to purchase larger supplies of hematite or refined pig-iron. This has had the effect of making supplies of hematite difficult; in fact, some makers are unable to consider further business until October. The engineering foundries are very busy in the production of high-duty castings.

The demand from home industries for all types of iron is such that no exports are now permitted. There is also urgent need for increased supplies of scrap, both steel and cast iron, as in recent months, owing to the shortage of pig-iron, larger supplies of scrap have been used.

It would appear that larger allocations of foundry coke are being made by the collieries, thus enabling the foundries to put a certain tonnage into stock against the leaner winter months when their coke allocations are smaller. Foundries have been able in recent weeks to place supplies of limestone and ganister in reserve. The engineering foundries are able to acquire their requirements in ferro-alloys without delay.

It is fortunate that the output of semi-finished steel from the home makers is improving, as this is giving a little relief to the hard-pressed re-rollers, who are feeling very much the lack of heavy tonnages of imported billets and sheet bars. All re-rollers of bars, light sections, strip and sheets are heavily committed for a long period ahead, much of the material being wanted for the priority classes. The sheet mills are under heavy pressure all round. The plate mills, too, are very busy, there being a far-reaching demand for all thicknesses.

Structural engineers are badly in need of joists, sections and plates, and long waiting periods are inevitable. It is not possible to get much assistance from stockholders, as their stocks are badly depleted. The collieries are taking considerable tonnages of arches, roofing bars, props, etc., and the tendency is for their demands to expand.

IT IS REPORTED that a steel mill is to be laid down in the State of Sinaloa, Western Mexico. The proposed site is near the local iron-ore deposits. The project, it is understood, will be financed by United States and Mexican capital.

Non-ferrous Metals

The Ministry of Supply has announced that the Combined Tin Committee has made a further interim allocation of tin metal for the second half of 1947 amounting to 15,710 tons. This allocation is in addition to a first interim allocation of 11,331 announced early last month. Together these total 27,041 tons and represent nearly all the tin that can be expected to be available during the remainder of this year. Although the Committee may be able to allocate small additional quantities later in the year, the present allocations will have to cover to a substantial degree the needs of the consumer countries for this period. The latest allocations to individual countries are as follow, the total allocations to date being shown in parentheses:—Australia, 172 (275) tons; Austria, 75 (97); Canada, 700 (1,000); Czechoslovakia, 347 (508); Denmark, 46 (165); Finland, 15 (50); France, 2,600 (4,115); Hungary, 203 (203); India, 2,738 (3,263); New Zealand, 125 (167); Norway, 51 (141); Poland, 2 (241); Sweden, 200 (493); Switzerland, 297 (522); Turkey, 96 (186); U.S.A., 7,907 (14,657); Uruguay, 16 (41); others, 120 (917 tons).

In recognition of the very long distances from producing areas to many consuming countries and of the meagre stocks with which some countries have to work, it was decided to entertain requests for minimum additional allocations to improve the working stock of such countries, providing the Committee is satisfied that their needs are urgent. A small reserve has been set aside to meet such needs. The Committee emphasises that tin-metal supplies available are sufficient to meet only a little more than half the requirements of importing countries for consumption during the period. Although tin production is increasing, normal supply conditions are not expected to prevail for some time to come. It has not been possible to make new allocations to certain countries at this time either because satisfactory statistical information has not yet been presented to the Committee or because purchases in excess of previous allocations have offset the quantities to which they would otherwise have been entitled.

Supplies may be obtained from the following sources:—United Kingdom, on behalf of Malaya and Hong Kong; the Netherlands, Belgium, China, Siam and the United States, for stocks of Japanese tin. In addition, small demands of certain Latin-American and Middle-Eastern countries may be met from British, Belgian, Dutch and U.S. sources.

There has been no further news of any possible re-opening of the free market in London, and it would seem that the Government still holds the view that the Ministry of Supply can serve the country better at this time of crisis than the merchants and importers who have spent years in the non-ferrous metals trade. The industry is, apparently, to be compelled to pay more for its raw materials than users overseas, and in due course this will lead to the loss of most of its export business.